

Biological spectrum of the vegetation of Ganganagar District of Rajasthan

B. P. Singh & Anil Arora

Department of Botany, SGN Khalsa College
Sriganganagar (Raj.) India

Abstract

Ganganagar district is situated in the North of Rajasthan. It constitutes a part of the Great Indian Desert and is under intensive cultivation and irrigation by a network of canals. In the present paper, the life-forms of the angiosperms belonging to 87 families, 328 genera and 539 species have been studied. The same has been compared with Raunkiaer's normal spectrum and other spectra of adjoining regions of the Indian Desert. The dominance of therophytes and cryptophytes indicate that the Phytoclimate of the district is thermo-cryptophytic which is characteristic of semi-arid zones.

INTRODUCTION

The district of Ganganagar, having an area of 20,629 sq. km., is situated in the north of Rajasthan State, between $28^{\circ} 40' - 30^{\circ} 6' \text{ N. Lat.}$ and $72^{\circ} 36' - 75^{\circ} 30' \text{ E. Long.}$ It constitutes a part of the Great Indian Desert. The district is being irrigated by the Gang Canal, Bhakra Canal and Rajasthan Canal which has greatly affected the natural flora of the area in many ways. The irrigation water which owe its source to Punjab rivers have been bringing seeds and other propagules of a number of extra-limital species year after year and many of these have successfully established in the area as crop weeds or along the bank of canals. The most wonderful example of this naturalization of Himalayan plants in the Great Indian Desert are species of *Riccia*, *Marchantia* and *Ophioglossum vulgatum* L. (Singh & Brar, 1980) which are found frequently in the canal irrigated areas, showing thereby the extent to which plants from the Himalayas and other places have become naturalised in this irrigated desert.

There are no rocks or gravelly soil in the district. In the irrigated tract soil under irrigation by Gang canal and Bhakra canal is sandy-loam. In the non-command area, sandy plains with stabilized and shifting sand dunes are a common sight in the South of the district and its adjoining districts Churu and

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Bikaner of Rajasthan. There is a seasonal river called Ghagger which enters the tehsil Tibbi in the East and, through Anupgarh, flows to Pakistan. The soil in the bed of this river is heavy clay. There are some saline areas near Jetsar and Anupgarh where a few halophytes occur. The average annual rainfall is 300 mm (June to September) with maximum rainfall in July-August. The summers are extremely hot and winters severely cold. The maximum and minimum average temperatures recorded are 44° c and 5° c, respectively.

Life-forms of plants reflect the major features of the climate. It further provides a sound basis for natural ecological classification. The classification suggested by Raunkiaer (1934) has been widely used and is based on the principles of position and degree of protection to perennating buds during the unfavourable 'cold' and 'dry' periods.

A biological spectrum is formed when all the species of higher plants of a community are classified into life-forms and their ratio is expressed in number or percentage. Geographically, widely separated plant communities can be very usefully compared with one another on the basis of their biological spectra. Since the life-form is related to the environment, the biological spectrum is also regarded as an indicator of the prevailing environment. Occurrence of a similar biological spectrum in different regions indicates similar climatic conditions. The bioclimate of a region, according to Raunkiaer, is characterized by the life-form(s) which in the biological spectrum of a region exceed the percentage of the same life-form in the normal spectrum. In most spectra, there is at least one life-form whose percentage value is much higher than that of the same life-form in the normal spectrum. This indicates the predominance of a particular type of climate that favours the development of that life-form in higher proportions. It must be argued, however that due to biotic disturbances the proportions of the life-form may change. Biotic influences like agricultural practices and grazing etc. may materially alter the biological spectrum by the introduction of Therophytes like annual weeds. Using Raunkiaer's life-form classification, Meher-Homji (1964, 1981) compared the biological spectra of various regions of India and showed that these spectra were related to the bioclimate of the region.

OBSERVATION AND DISCUSSION

The present work is based on extensive floristic exploration of the districts of North Rajasthan (Ganganagar, Bikaner and Churu) (Singh, 1982, 1989; Singh & Brar, 1980, 1984; Singh & Dhillon, 1989; Singh & Sidhu, 1990; Singh & Singh, 1990). The classification of plants into their life-forms has been done as recognised by Raunkiaer (1934) or with a few modifications (Braub-Blanquet, 1932; Dansereau, 1957).

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Among the 539 angiosperm species collected from the area, life-form analysis indicate 52.24 percentage of therophytes which is 4 times more than in Normal Biological Spectrum (NBS). The percentage of cryptophytes (11.20%) is also substantial and exceeds NBS by approximately 1.9 times. The percentage of the remaining life-form classes, namely phanerophytes (19.4%), chamaephytes (5.78%) and hemicryptophytes (11.38%) is much lower than in NBS. Thus, we find that the therophytes and cryptophytes are more abundant in the district.

The biological spectrum of Ganganagar district when compared with other regions (Table-1) reveal a higher percentage of therophytes and cryptophytes and relatively lower percentage of phanerophytes, chamaephytes and hemicryptophytes. This is because the therophytic climate is favourable for the growth of annuals or therophytes, which are best adapted to tide over the unfavourable period in the form of seeds. The predominance of therophytes is indicative of a warm dry climate in conformity with Bioclimate diagram of Dansereau (1957).

Table: 1

Regions	No. of dry Months	Percentage distribution of Life-Forms					Phyto-climate
		Ph	Ch	H	Cr	Th	
Normal spectrum	—	46.0	9.0	26.0	6.0	13.0	
Extreme arid Regions of Indian Desert (Mertia & Bhandari, 1980)	10—12	34.0	9.0	6.0	2.0	49.0	Therophytic
Semi arid zone of Northern India (Mehar-Homji, 1964)	9—12	30.3	18.3	10.2	8.2	33.0	Therophytic
Semi-arid Punjab (Sharma et al., 1987)	9—12	13.7	6.7	13.9	11.0	54.7	Therocryptophytic
Ganganagar district (present work)	9—12	19.4	5.8	11.4	11.2	52.2	Therocryptophytic
Ph—Phanerophytes Cr—Cryptophytes		Ch—Chamaephytes Th—Therophytes					H—Hemicryptophytes

The percentage of cryptophytes (geophytes & hydrophytes) has increased due to increased water facilities in the area on account of network of canals. The higher percentage of geophytes as against the NBS may be due to slightly more humid and warm conditions as compared to other regions and also due to loose, fertile upper soil horizon which favours the development of the perennating organs of geophytes.

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The poor representation of phanerophytes, indicators of wet tropical forests, is due to unfavourable climatic conditions like longer period of dry months, relatively less annual rainfall and therefore, less humidity. The other reason for poor representation of phanerophytes is conspicuous decrease in the percentage of nano-phanerophytes due to tremendous irrigation facilities and extensive cultivation in the area.

The chamaephytes and hemicryptophytes are indicators of cold zones, their presence comparatively in less number is quite understandable. Though the epiphytes (0.9%) are poorly represented in the area as compared to normal spectrum but the percentage of lianas (2.37%), including *Ephedra foliata* Boiss. et Kotschy ex Boiss., is substantial.

The biological spectrum of the area under discussion shows the dominance of therophytes and cryptophytes as compared to NBS. So the phytoclimate of the region may be considered therocryptophytic characteristic of semi-arid regions. Thus, the present result supports Raunkiaer's concept of correlation between phytoclimate and the statistical distribution of life-forms in the flora of a region. Meher-Homji (1981) had observed that the thermo-cryptophytic type of phytoclimate is found where the rainfall is of the order of less than 600 mm with 8 dry months in a year. This also appears to be applicable to the floristic region under discussion.

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